



RESEARCH DEPARTMENT

TELEVISION AND V.H.F. SOUND TRANSMITTER SITE TESTS AT NETHER BUTTON, ORKNEY

Report No. K-142

(1960/4)

**THE BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION**

RESEARCH DEPARTMENT

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Section	Title	Page
	SUMMARY	1
1	INTRODUCTION	1
2	GENERAL	1
3	RESULTS	2
	3.1. Television	2
	3.2. V.H.F. Sound	4
4	RECEPTION TESTS OF MELDRUM IN CAITHNESS AND ORKNEY	4
5	CONCLUSIONS	7
	5.1. Television Service	7
	5.2. V.H.F. Sound Service	7
6	REFERENCE	7
	APPENDIX	8

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SUMMARY

This report gives the results of television and v.h.f. sound transmitter site tests at Nether Button, Orkney. With the effective radiated powers (e.r.p.s) proposed at Nether Button a satisfactory service will be provided to a very large proportion of the population of Orkney and the north coast of Caithness, including most of Thurso.

Reception tests of the Meldrum television transmission showed that the field strength at Nether Button was not adequate for r.b.r. purposes. As a result of testing a number of sites, the G.P.O. station at Thrumster, in Caithness, was found to be the most suitable location for the first link in feeding the programme to Nether Button.

The field strength of the Meldrum v.h.f. sound transmission was also found to be strong enough at Nether Button to provide a reasonable, temporary v.h.f. service.

1. INTRODUCTION

Among the sites investigated in Orkney for a television and v.h.f. sound station the disused Air Ministry premises at Nether Button had many advantages. Although possibly not the ideal choice of a site for the station it has two 350 ft (107 m) steel towers, power supplies and ample accommodation and it was thought worth-while to test the site to determine the service area that could be expected and the transmitter power required.

Reception tests were made of the Meldrum television and v.h.f. sound transmissions to determine the reliability of the received signal for r.b.r. purposes. Similar reception tests were also made at other sites in Orkney and in Caithness to determine the best method of feeding programme to Nether Button.

2. GENERAL

The test transmissions on Band I were radiated on a frequency of 63.25 Mc/s (Channel 5 sound) using an end-fed vertical dipole aerial mounted on the top of the north-easterly 350 ft (107 m) tower. The e.r.p. was 20 watts.

The Band II transmissions were radiated on a frequency of 91.9 Mc/s by an aerial mounted at the same level. The e.r.p. was 13 watts. The Band II transmission was square-wave modulated so that more sensitive receiving equipment might be used.

The measuring technique was the same as in other field strength surveys and all field strength values are corrected for a receiving aerial at 30 ft (9.1 m) above ground level.

The Channel 5 test transmission power being very low (20 watts) relative to the maximum e.r.p. of the proposed transmitter (13.7 kW), the field strength conversion factor from test to final transmitter condition was correspondingly high. It was, therefore, necessary to use some of the Band II ($f = 91.9$ Mc/s) square-wave transmission data to determine the outer limit of the Band I service area map in the direction of maximum e.r.p.

Furthermore, to save time, parts of the survey in Orkney were not repeated in Band II and the Band I figures have been corrected and used in plotting the Band II map.

Both test transmissions were radiated by omnidirectional aerials and the measured results have been corrected to correspond with the horizontal radiation patterns (h.r.p.s) shown in Figs. 1 and 2 for the television and v.h.f. sound services respectively. The major axes of both the h.r.p.s lie along the bearing $40^\circ/220^\circ$, ensuring the maximum possible field strength in the directions of Shetland and Caithness.

These patterns will give the best service area and it is hoped will also provide a signal at a selected site in Shetland sufficient for r.b.r. purposes when this is required.

The maximum and minimum e.r.p.s of the television and v.h.f. sound transmissions are 4.0 to 13.7 kW and 3.1 to 20.4 kW respectively.

Reception tests of the Meldrum transmissions, to determine the suitability of a relay link, were made at four sites in Orkney and three sites in Caithness.

Site details are given in the Appendix.

3. RESULTS

3.1. Television

The results of the Channel 5 transmission tests are presented in a field strength contour map (T.483), Fig. 3, while the details of the field strengths expected in the principal towns are given in Table 1.

TABLE 1

Field strength in mV/m at 30 ft (9.1 m) A.G.L.

E.R.P. = 4.0-13.7 kW

Town	Value of field strength exceeded for percentage of localities		
	10%	50%	90%
Kirkwall	8.0	3.5	1.4
Stromness	2.0	1.2	0.5
Thurso	1.0	0.45	0.16
Wick	0.45	0.22	0.1

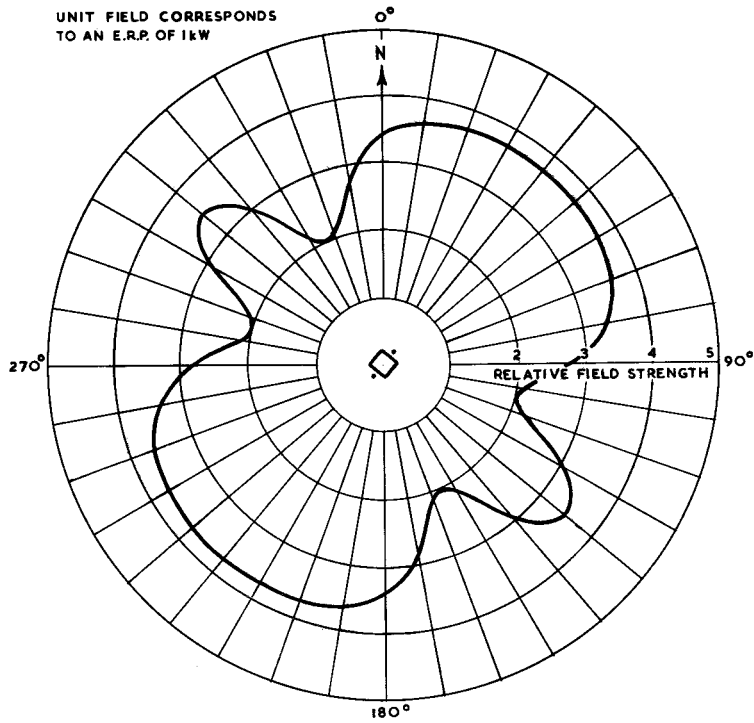


Fig. 1 - H.R.P. of Orkney Channel 5 transmitter

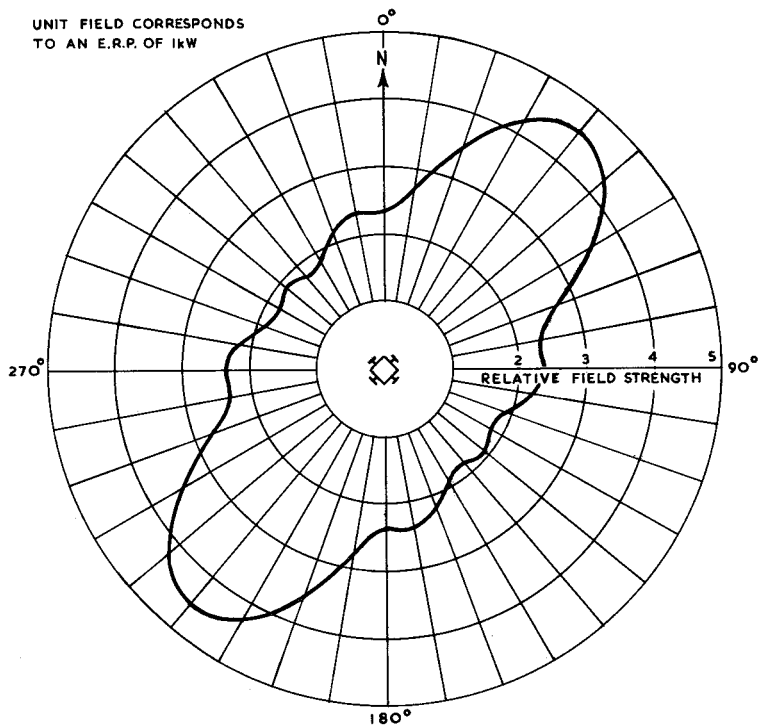


Fig. 2 - H.R.P. of Orkney Band II transmitter

It will be seen from Fig. 3 that Orkney will receive a very good service, 90% of the population being within the 0.5 mV/m contour. The north coast of Caithness, including most of Thurso, will also have a good service but, as reference to Table 1 shows, parts of Wick are poorly served. Wick does, however, receive a very good service from the Thrumster transmitter.

Some observations of sea scatter¹ were made at Kirkwall, using a dipole and reflector receiving aerial up to heights of 28 ft (8.5 m) above ground level. The checks were made during a period of fairly calm weather and scatter was not observed except where the receiving aerial was shadowed by buildings. Only along two short stretches was it impossible to eliminate the scatter by using an H aerial, and in these localities the interference was slight.

3.2. V.H.F. Sound

The results of the Band II measurements are presented in a field strength contour map (F.132), Fig. 4, while details of the field strengths in the principal towns are given in Table 2.

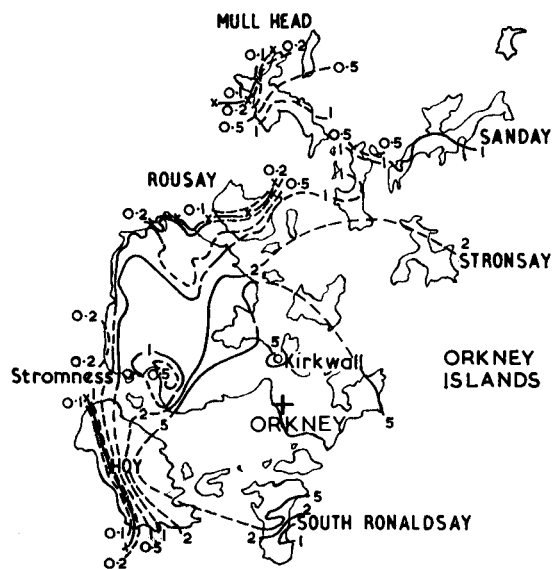
TABLE 2
Field strength in mV/m at 30 ft (9.1 m) A.G.L.
E.R.P. = 3.1-20.4 kW

Town	Value of field strength exceeded for percentage of localities		
	10%	50%	90%
Kirkwall	9.0	4.0	1.6
Stromness	2.5	1.4	0.6
Thurso	2.2	0.8	0.35
Wick	0.4	0.2	0.08

Orkney is very well served. It is estimated that 20,100 of a total population of 21,300 are within the 0.25 mV/m contour. A large part of Caithness also lies within the 0.25 mV/m contour, almost exactly one half of the population of the county receiving 0.25 mV/m or more. Wick is the only large town in which the median field strength is less than 0.25 mV/m but it will get a very good service when the Thrumster v.h.f. station comes into operation.

4. RECEPTION TESTS OF MELDRUM IN CAITHNESS AND ORKNEY

The field strength of the Meldrum television and v.h.f. sound transmissions was recorded at a number of sites in Orkney, including Nether Button, and at a number of sites in Caithness. Briefly, the outcome of these tests was that the field strength of the Meldrum television transmission was inadequate at any site in Orkney and the best location for an intermediate link was found to be the Post Office site at Thrumster, 3½ miles (5.6 km) south of Wick. It was, therefore, decided to establish the first intermediate link at Thrumster, to re-radiate the signal on Channel 1, thus providing an excellent service in most parts of Caithness, and to establish the second link at an advantageous point near the north coast, whence the signal would be fed by s.h.f. to Nether Button.



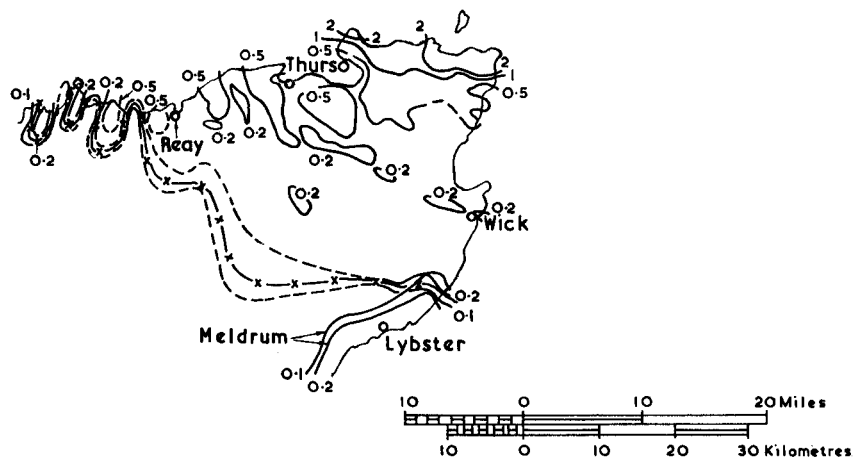
Note:

The contours represent field strength in mV/m at 30ft (9.1m) above ground exceeded at 50% of receiving sites in a given locality. The value exceeded at 90% of receiving sites may be as much as 10dB below the value indicated by the contours particularly in hilly and built-up areas.

—x— Limit of service area free from perceptible co-channel interference for 90% of the time. The protection ratio on which the estimates are based is 30dB with a reduction of 10dB for crossed-polarization.

Population within:

Field strength mV/m	Orkney	Caithness
5	5,000	—
0.5	19,200	3,000
0.1	21,000	20,200



ORKNEY

CHANNEL 5 (66.75Mc/s)

(DERIVED FROM SITE TEST MEASUREMENTS)

SITE HEIGHT: 180ft (55m) AMSL

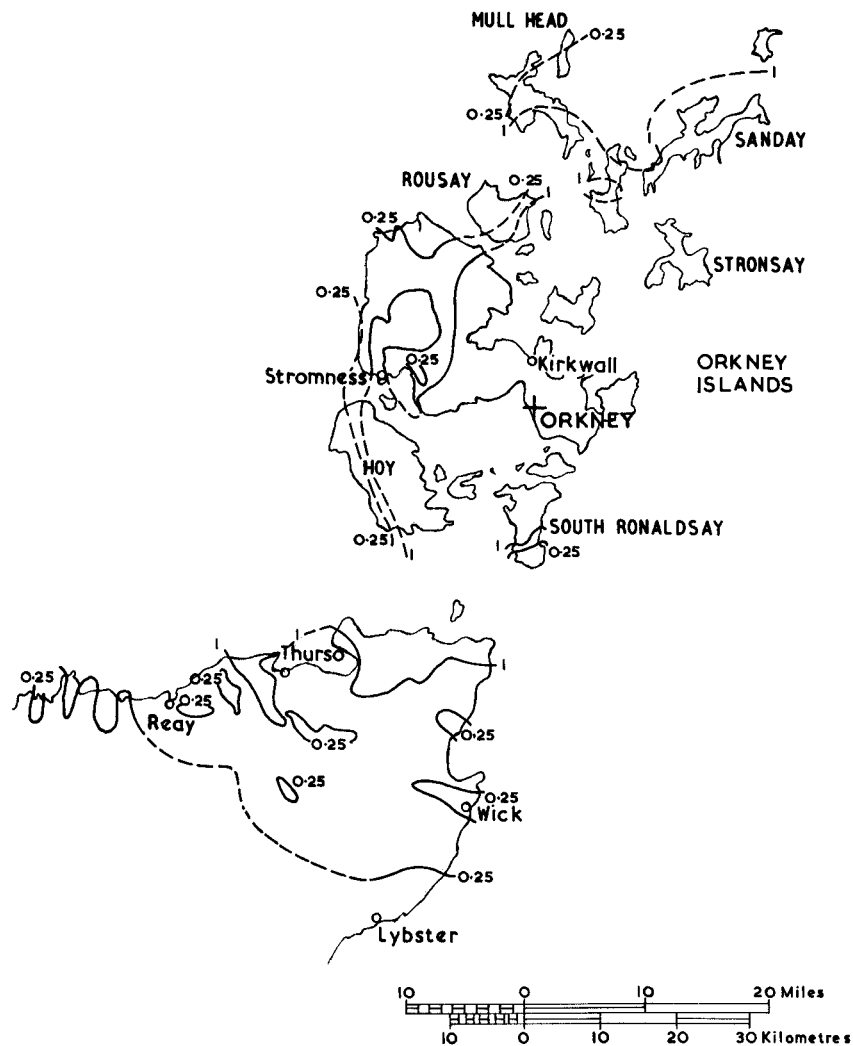
AERIAL HEIGHT: 350ft (107m) AGL

E.R.P.: 4.0kW-13.7kW

AERIAL: EIGHT TIERS EACH
OF TWO DIPOLES.

POLARIZATION: VERTICAL

Fig. 3



Note:

The contours represent field strength in mV/m at 30ft (9.1m) above ground exceeded at 50% of receiving sites in a given locality. The value exceeded at 90% of receiving sites may be as much as 10 dB below the value indicated by the contours particularly in hilly and built-up areas.

Population within:

Field strength mV/m	Orkney	Caithness
1	18,000	1,500
0.25	20,100	11,900

ORKNEY

BAND II

(DERIVED FROM SITE TEST MEASUREMENTS)

SITE HEIGHT: 180ft (55m) AMSL

AERIAL HEIGHT: 260ft (79m) AGL

E.R.P.: 3.1kW-20.4kW

AERIAL: EIGHT TIERS:

FOUR TIERS EACH OF FOUR DIPOLES.

FOUR TIERS EACH OF TWO DIPOLES.

Fig. 4

The field strength at Nether Button, 150 ft (46 m) above ground level, of the Meldrum v.h.f. transmissions was found to be approximately 0.16 mV/m for 50% of the time, a signal which will provide a reasonably good temporary v.h.f. service for a large proportion of the time. When the Thrumster v.h.f. transmission starts, and is picked up at Nether Button, the r.b.r. service will be very much improved.

5. CONCLUSIONS

5.1. Television Service

A transmitter at Nether Button with a directional aerial radiating on Channel 5 would give good general coverage in Orkney and in most of the country areas of Caithness. The field strength in Wick will be inadequate but the transmitter at Thrumster will provide a very good signal there and will be used as the first intermediate link to Nether Button.

5.2. V.H.F. Sound Service

The proposed v.h.f. sound transmitter at Nether Button will provide a very good service in Orkney and in most of the country areas of Caithness, while the proposed transmitter at Thrumster will serve Wick and areas outside the range of the Nether Button transmitter. The r.b.r. facilities at Nether Button will be greatly improved when the Thrumster v.h.f. transmitter comes into service.

6. REFERENCE

1. "Observations on the Interference to the Television Transmission from North Hessary Tor, Caused by Back-scatter from the Sea", Research Department Report No. K-129, Serial No. 1957/24.

APPENDIX

Site Data

Nether Button

Latitude:	58° 55' 24" N
Longitude:	02° 56' 10" W
National Grid Reference:	HY/462045
Site Height:	180 ft (55 m) A.M.S.L.

Thrumster

Latitude:	58° 23' 38" N
Longitude:	03° 07' 22" W
National Grid Reference:	ND/344456
Site Height:	236 ft (72 m) A.M.S.L.